3

Environmental Program Information

Introduction

Lawrence Livermore National Laboratory is committed to operating in a manner that preserves the quality of the environment. The Environmental Protection Department leads this effort in the areas of environmental compliance and accountability. This chapter begins with a brief description of LLNL's integrated Environmental, Safety, and Health (ES&H) Management System, and continues with discussions of Work Smart Standards, missions, and activities of EPD and its three divisions. Performance measures (PMs) used by DOE to evaluate the Laboratory's environmental protection efforts are then summarized. The bulk of the chapter is devoted to an account of LLNL's activities and progress in waste minimization and pollution prevention in 1998. Following descriptions of current issues and actions in the environmental program arena, this chapter concludes with a brief discussion of spill response and EPD environmental training.

Integrated Environmental, Safety, and Health Management System

Protecting people and the environment is the most important consideration in day-to-day operations at LLNL. Attention to environmental, safety, and health factors is fully integrated into the Laboratory's research programs and operational culture. This integrated management approach requires accountability at all levels of the organization, project planning with protection in mind, and excellence in program execution. The ES&H Program at LLNL employs a process of assessing hazards and the environmental implications of work; designing and implementing standards-based methods intended to control risks; and complying with the applicable ES&H regulations. This process is implemented using a graded approach, which increases the level of risk management as the hazard increases. An overview of the Laboratory's current ES&H Program and a general description of how the Laboratory manages ES&H activities can be found in *The Environmental, Safety, and Health Program at Lawrence Livermore National Laboratory* (Lawrence Livermore National Laboratory 1996).

In October 1996, the Department of Energy issued DOE Policy 450.4: Safety Management System Policy. This policy provides a formal, organized process whereby employees plan, assess, and improve safety in their work. In this policy statement the term "safety" is used comprehensively to include environment, safety, and health. The policy was developed taking into consideration various consensus management standards such as International Standards Organization (ISO) 14000, Voluntary Protection Program (VPP), and Recommendation 95-2 from the Defense Nuclear Facility Safety Board. Integrated ES&H management systems are defined as having five functions: to define the scope of work, analyze hazards, develop and implement standards-based controls, perform work, and provide feedback and improvement. Though the current LLNL ES&H management process reflects the requirements of these five functions, LLNL is moving towards a formal integrated safety management system (ISMS). In December of 1998, LLNL submitted its ISMS description to DOE. This description articulates the institutional requirements for all LLNL operations and the requirements to be used in the institutional ES&H manuals and individual directorate implementation plans. The description also includes a description of the major tasks, schedules, and milestones for implementation of ISMS. It also describes the parallel preparation of the Work Smart Standard Process, an integral part of ISMS that identifies the standards to be implemented under ISMS. Full implementation of ISMS will occur in 2000.

Work Smart Standards

In 1997, LLNL and DOE's Oakland Operations Office (DOE/OAK) inaugurated a Work Smart Standards (WSS) process, whereby safety professionals from both organizations identify hazards and establish standards of operation appropriate for the particular work environment. WSS will improve both safety and the working relationship between the DOE and LLNL and are expected to become part of the DOE contract with the University of California. DOE made the use of an environmental, safety, and health management system a policy (DOE Policy 450.4), an acquisition regulation (48 CFR 970.5204-2), and a contract requirement.

The WSS process (DOE M450.3-1) requires an understanding of the work, an analysis of the hazards associated with the work, and the selection of standards from which hazard controls are developed. LLNL has traditionally identified and controlled hazards to protect the LLNL staff, the public, and the environment, but the WSS process differs from the past in that responsibility for selection of appropriate and necessary standards is in the hands of both the DOE field office and LLNL. This process empowers the Laboratory and local DOE staffs, through consensus, to focus on the work being

performed and to select sitewide environmental, safety, and health standards based on the actual work being conducted and its associated hazards and threats to the environment. During 1998, several hundred individuals participated in the WSS process, including over 100 subject matter experts who identified standards based on the work and the hazards. In addition, requirements for managing processes were identified to better connect project planning and execution with the standards, thereby providing protection to people and the environment. This process resulted in the identification of almost 700 individual requirements, with over 250 directly related to environmental protection. The WSS process also identified the need to develop nine local standards to either fill gaps or enhance existing standards; these ranged from standards on ergonomics to HEPA filters. Specifically, radioactive waste storage facility and tank system design criteria standards (Wood et al. 1999) were developed to ensure that requirements for facility design protect the environment.

These standards were approved at the management level closest to the work. Others cannot approve the set, require concurrence, or second-guess the standards selected. The LLNL Director and DOE Oakland Operations Office Manager will approve the final set of sitewide standards when they are confirmed in 1999 by an independent panel of external experts. Reaching these agreements with DOE on new work-based standards will align the Laboratory with industry practice; establish common environmental, safety, and health expectations for DOE and the University of California; and facilitate the tailoring of requirements to streamline and increase the effectiveness of management at the Laboratory. The existing ES&H methodologies and documentation are being modified to incorporate the newly identified set of standards and to reflect the requirements of ISMS.

Meeting new expectations for integrated ES&H management at the Laboratory will take several years, but the WSS approach coupled with enhanced, integrated management promises further safety improvements and lower costs.

Environmental Protection Department

The Environmental Protection Department (EPD) is the lead organization for environmental support to operations at LLNL. It is responsible for environmental monitoring, environmental regulatory compliance, environmental restoration, and hazardous waste management in support of the Laboratory's programs. EPD prepares and maintains environmental plans and guidelines, provides environmental guidance

and support to Laboratory personnel, informs management about pending changes in environmental regulations pertinent to LLNL, represents the Laboratory in day-to-day interactions with regulatory agencies, and assesses the effectiveness of pollution control programs.

EPD monitors air, water, soil, and foodstuff, as well as direct radiation; evaluates possible contaminant sources; and models the impact of LLNL operations on humans and the environment. In 1998, 15,686 samples were taken from air, sewage, ground water, surface water, soil, sediments, vegetation, and foodstuff. Almost 244,000 analytes were tested. These numbers represent a substantial decrease in the number of samples taken and a small decrease in the number of analytes tested, compared to 1997 values. The type of samples collected at a specific location depends on the site and the potential pollutants to be monitored; see the specific chapters of this report for discussions of each environmental medium.

A principal part of EPD's mission is to work with LLNL programs to ensure that operations are conducted in a manner that limits environmental impacts and is in compliance with regulatory guidelines. EPD helps LLNL programs manage and minimize hazardous, radioactive, and mixed wastes; determines the concentrations of environmental contaminants remaining from past activities; cleans up environmental contamination to acceptable standards; responds to emergencies in order to minimize and assess any impact on the environment and the public; and provides training programs to improve the ability of LLNL employees to comply with environmental regulations.

LLNL programs are supported by EPD's four ESTs. The ESTs are integrated into the Environmental, Safety and Health Teams (ES&H Teams) at the Laboratory through the Environmental Analyst who chairs the ESTs. Each EST includes representatives from environmental specialties within the Operations and Regulatory Affairs Division (ORAD), along with a field technician from the Hazardous Waste Management Division. Some ESTs also include a representative from the Environmental Restoration Division (ERD), the ES&H Teams, or the organizations supported by the ESTs. These teams evaluate operations, determine potential environmental impacts, and provide guidance on environmental regulations and DOE orders for existing and proposed projects. ESTs assist programs in planning, implementing, and operating projects and in understanding and meeting their environmental obligations. When permits are obtained from regulatory agencies, ESTs aid the program in evaluating the permit conditions and implementing recordkeeping requirements.

Operations and Regulatory Affairs Division

ORAD currently consists of eight groups that specialize in environmental compliance and monitoring and provide laboratory programs with a wide range of information, data, and guidance to make more informed environmental decisions.

ORAD prepares the environmental permit applications and related documents for submittal to federal, state, and local agencies; provides the liaison between LLNL and regulatory agencies conducting inspections; tracks chemical inventories; prepares National Environmental Policy Act (NEPA) documents; conducts related field studies for DOE; oversees wetland protection and floodplain management requirements; coordinates cultural and wildlife resource protection and management; facilitates and provides support for the pollution prevention and recycling programs; teaches numerous environmental training courses; coordinates the tank environmental compliance program; conducts compliance and surveillance monitoring; and provides environmental impact modeling and analysis, risk assessment, and reporting.

ORAD also actively assists in responding to environmental emergencies such as spills. During normal working hours, an Environmental Analyst from the ORAD Environmental Operations Group responds to environmental emergencies and notifies a specially trained Environmental Duty Officer. Environmental Duty Officers are on duty 24 hours a day and coordinate with LLNL's ES&H Team and other first responders or environmental specialists.

Hazardous Waste Management Division

All hazardous, radioactive, and mixed wastes generated at LLNL facilities are managed by the Hazardous Waste Management (HWM) Division in accordance with state and federal requirements. HWM processes, stores, packages, solidifies, treats, and prepares waste for shipment and disposal, recycling, or discharge to the sanitary sewer.

As part of its waste management activities, HWM tracks and documents the movement of hazardous, mixed, and radioactive wastes from waste accumulation areas (WAAs) located near the waste generator to final disposition; develops and implements approved standard operating procedures; decontaminates LLNL equipment; ensures that containers for shipment of waste meet the specifications of the U.S. Department of Transportation (DOT) and other regulatory agencies; responds to emergencies; and participates in the cleanup of potential hazardous and radioactive spills at LLNL facilities. HWM prepares numerous reports, including the annual and biennial

hazardous waste reports required by the state and federal environmental protection agencies (see Appendix C). HWM also prepares waste acceptance criteria documents, safety analysis reports, and various waste guidance and management plans.

HWM meets regulations requiring the treatment and disposal of LLNL's mixed waste in accordance with the requirements of the Federal Facility Compliance Act. The schedule for this treatment is negotiated with the State of California and involves developing new on-site treatment options, as well as finding off-site alternatives.

HWM is responsible for implementing a program directed at eliminating the backlog of legacy waste (waste that is not presently certified for disposal). This effort includes a large characterization effort to identify all components of the waste, and a certification effort, which will provide appropriate documentation for the disposal site.

Environmental Restoration Division

The Environmental Restoration Division (ERD) was established to evaluate and remediate contaminated soil and ground water resulting from past hazardous materials handling and disposal and from leaks and spills that have occurred at the Livermore site and Site 300, both prior to and during LLNL operations. ERD investigates field sites at both the Livermore site and Site 300 to characterize the existence, extent, and impact of contamination. ERD evaluates and develops various remediation technologies, makes recommendations, and implements actions for site restoration. ERD is responsible for managing remedial activities, such as soil removal and ground water extraction, and for assisting in closing inactive facilities in a manner designed to prevent environmental contamination.

As part of its responsibility for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) compliance issues, ERD plans, directs, and conducts assessments to determine both the impact of past releases on the environment and the restoration activities needed to reduce contaminant concentrations to protect human health and the environment. ERD is responsible for interacting with the community on these issues. Several public meetings are held each year as required in the ERD CERCLA Community Relations Plans. To comply with CERCLA ground water remedial actions at the Livermore site, ERD has to date designed, constructed, and operated five fixed ground water treatment facilities and associated pipeline networks and wells, seven portable ground water treatment units and two soil vapor extraction facilities (see Chapters 7 and 8). At Site 300, ERD has designed, constructed, and operated two soil vapor extraction facilities and four ground water extraction and treatment facilities.

ERD is actively designing, testing, and applying innovative remediation and assessment technologies to contaminant problems at the Livermore site and Site 300. ERD provides the sampling and data management support for ground water surveillance and compliance monitoring activities.

Performance Measures Summary

Since 1992, the contract that the University of California has to manage and operate LLNL for DOE has contained performance objectives, criteria, and measures. Four of these performance measures (PMs) were used to evaluate LLNL's environmental protection activities.

At the end of 1998, DOE gave LLNL an average score of excellent for its environmental performance in 1997. DOE scores for individual performance measures are shown in **Table 3-1**. Performance is described in the *Environmental Report 1997* (Harrach et al. 1998). Data for calendar year 1998 will be included in the annual self-assessment and evaluation conducted August through December 1999.

DOE Pollution Prevention Goals

The Secretary of Energy has committed the Department to the following Pollution Prevention (P2) goals, which are to be achieved throughout the complex by December 31, 1999, using 1993 as a baseline:

1. Reduce total releases and off-site transfers for treatment and disposal of Emergency Planning and Community Right-to-Know Act (EPCRA) 313 toxic chemicals from routine operations by 50%.
2. Reduce the generation of radioactive waste from routine operations by 50%.
3. Reduce the generation of low-level mixed waste from routine operations by 50%.
4. Reduce the generation of hazardous waste from routine operations by 50%.
5. Reduce the generation of sanitary waste (after recycling) from routine operations by 33%.
6. Divert 33% of sanitary waste from all operations for recycling.
7. Increase the affirmative procurement of Environmental Protection Agency (EPA) designated recycled products to 100%.

Table 3-1. Contract 48 environmental protection performance measures.

PM designator	Performance measure	Location in *Environmental Report 1998*	Score
1.5.b	**Radiation Dose to the Public** Public radiation doses to the maximally exposed individual from DOE operations will be measured or calculated and controlled to assure that doses are kept as low as reasonably achievable.	Chapter 12: Radiological Dose Assessment; section on Radiological Doses from 1998 operations. Chapter 2: Compliance Summary section on National Emission Standards for Hazardous Air Pollutants.	Outstanding
1.5.g	**Process and Solid Waste Generation** (Waste Reduction and Recycling) The Laboratory continues to progress towards meeting the DOE's pollution prevention goals for the year 2000.	This chapter, section on Waste Minimization/Pollution Prevention.	Excellent
1.5.h	**Environmental Violations** The rate of validated environmental violations from inspections and reporting requirements from regulatory agencies is kept low.	Chapter 2: Compliance Summary, **Table 2-8**.	Excellent
1.5.i	**Environmental Releases** The Laboratory controls occurrences of environmental releases exceeding regulatory or permitted levels imposed by local, state, or federal agencies.	Chapter 2: Compliance Summary, **Table 2-13**.	Marginal

Progress toward achieving these goals is reported annually to the Secretary of Energy in DOE's *Annual Report on Waste Generation and Pollution Prevention Progress* (U.S. Department of Energy 1994, 1996a, 1997, 1998d, and 1999).

The DOE's *Pollution Prevention Program Plan 1996* (U.S. Department of Energy 1996b) established six immediate priorities, due to be implemented by fiscal year 1998, which will help DOE Headquarters, the Operations Offices, and the sites focus resources on the most critical aspects of DOE's P2 program.

The six priorities are to: (1) establish senior management commitment to P2 implementation, (2) set quantitative, site-specific waste reduction and recycling goals, (3) institute performance measures, (4) implement cost-saving P2 projects, (5) design P2 into new products, processes, and facilities, and (6) ensure that site programs comply with federal, state, and DOE requirements.

LLNL prepared a P2 Plan that meets the requirements of (1) DOE Orders 5820.2A and 5400.1; (2) RCRA Sections 3002(b) and 3005(h); and (3) Title 22 of the California Code of Regulations. This plan is reviewed annually and updated every three years; it was last updated and submitted to the DOE in May 1997 (Celeste 1997). The plan reviews past and current pollution prevention activities and states the objectives of LLNL's waste minimization and pollution prevention efforts.

The P2 Program at LLNL is an organized, comprehensive, and continuing effort to systematically reduce solid, hazardous, radioactive, and mixed-waste generation. The P2 Program is designed to eliminate or minimize pollutant releases to all environmental media from all aspects of the site's operations. These efforts help protect public health and the environment by reducing or eliminating waste management and compliance costs, resource usage, inventories and releases of hazardous chemicals, and civil and criminal liabilities under environmental laws.

In accordance with EPA guidelines and DOE policy, a hierarchical approach to waste reduction (i.e., source elimination or reduction, material substitution, reuse and recycling, and treatment and disposal) has been adopted and is applied to all types of waste.

Waste Minimization/Pollution Prevention

LLNL is required by UC Contract performance measure 1.4 g to annually review its waste generation for pollution prevention opportunities and to propose implementation projects. Previously, waste streams at LLNL were evaluated in terms of the total quantities of waste generated. However, the waste streams of greatest concern are not necessarily those having the largest volume. Each process that generates waste must be considered, as well as the individual characteristics of the components within each waste stream.

LLNL continues to use a weighted system to better rank the waste streams and to improve the prioritization of waste minimization efforts. The methodology assigns to each waste stream three weighting factors plus a factor based on annual quantity of waste generated. The three weighting factors use the following criteria: cost, waste type (which includes compliance and liability considerations), and operational aspects (such as routine vs nonroutine) as discussed in the *1997 Comprehensive Opportunity Assessment for Pollution Prevention at Lawrence Livermore National Laboratory* (Celeste et al. 1998).

In general, the 20 waste stream components having the highest priority (ranked by summing the four weighting factors) are entirely different from the top 20 sources ranked by quantity only. For example, transuranic waste (TRU)/TRU mixed and low-level wastes, which are problematic at LLNL, are now ranked as having the highest priority, though their relative quantities are somewhat low.

Routine waste generation by waste category, from 1993 through 1998, is shown in **Table 3-2**. In fall 1998, DOE/OAK expressed concern that the quantity of waste that LLNL reported for 1993 may not have been tracked and recorded as accurately as the waste quantities that were reported using criteria that were developed after 1993. Additionally, since 1994, LLNL has reported the waste quantities using new, improved technologies and procedures. Waste volumes for the years 1994 through 1997 were plotted using regression analysis to estimate the amount of waste generated in 1993.

Those new values for the years 1993 to 1998 are shown in **Table 3-2**. The trend from 1993 on shows a dramatic reduction in all waste categories, which is the result of a proactive P2 program at LLNL.

Table 3-2. Routine waste generation totals, 1993 to 1998 (in tons).

Waste category	1993 (Baseline)	1994	1995	1996	1997	1998
Low-level radioactive	256	181	136	91	68	73
Low-level mixed	34	26	36	23	21	25
Hazardous	628	368	368	360	240	232
Sanitary	2600	2246	2246	2001	2017	2201
LLNL totals	3518	2821	2786	2475	2346	2531

Table 3-3 presents the percent reductions in routine waste generation for 1998 compared to the 1993 baseline. With the decreases in routine radioactive and hazardous waste generation in 1998, the laboratory has already met the 50% reduction goal for the performance measure. In the last two quarters of 1998, operational changes resulted in added processing of low-level, liquid mixed waste. This reprocessing added to the total solid low-level mixed waste.

Table 3-3. Routine waste reduction, 1998.

Waste category	Reduction 1998 vs 1993 (%)
Radioactive	71.5
Mixed	26.5
Hazardous	63.1
Sanitary	15.3

Nonhazardous Solid Waste Minimization

In 1998, LLNL sent 4705 tons of nonhazardous waste, including routine and nonroutine, (designated sanitary waste in the above tables) to a landfill. The routine portion was 2201 tons, and the nonroutine portion was 2504 tons. The breakdown is shown in **Table 3-4**.

Table 3-4. Nonhazardous landfill totals (in tons), 1998.

Landfill	1998 total
Routine	
Compacted	2093
Industrial (TWMS)[a]	52
Routine subtotal	2201
Nonroutine	
Construction demo (non-compacted)	2446
Industrial (TWMS)	58
Nonroutine subtotal	2504
LLNL total	4705

[a] TWMS = Total Waste Management System.

Diverted Waste

The total waste diverted from landfills in 1998 was 31,513 tons. This year's total is comparable with that for 1996, although it is significantly less than the diversion total for 1997. Last year there was a more than 25-fold increase over 1996 because there was an increase in soil reuse, which was predominately driven by the National Ignition Facility (NIF) construction. Soil is reused on site and at the landfill for daily cover, and we continue to use asphalt as road base material at the landfill (3860 tons). The waste diversion summary is shown in **Table 3-5**.

For 1998, the total of the diverted waste and nonhazardous waste sent to landfill was 36,218 tons. The recycling rate for nonhazardous waste is calculated by dividing the diverted waste by the total of the landfill plus the diverted waste total. This results in a recycling rate of 87% for the nonhazardous waste for 1998.

One component of the LLNL waste stream that is successfully recycled consists of wood waste created by broken pallets, shipping crates, and demolition or construction scrap. This wood cannot be cost-effectively reused on site, so it is gathered in a collection yard for vendor removal at a cost lower than that of other disposal alternatives. Intact pallets and other reusable wood remain on site for internal reuse. In 1998, LLNL diverted 346 tons of wood from its solid waste stream.

Table 3-5. Waste diversion summary table, 1998.

Description	Cumulative 1998 total (tons)
Asphalt	3,860
Batteries	30
Cardboard	120
Compost	297
Cooking grease/food	3
Diverted soil	24,606
Hazardous Waste Management recycled materials	343
Magazines, newspapers and phone books	161
Metals	1,434
Paper	290
Tires and scrap	25
Toner cartridges	2
Wood	346
LLNL diversion total	31,517

Another waste reduction method converts landscape clippings from the site's lawns, trees, shrubs, and annual plantings into compost. Once it is properly aged, the compost is used on site as a soil amendment. By generating its own soil builders, LLNL benefits twice: by eliminating an organic waste stream (with no tipping fees or hauling required), and by saving the purchase cost of new material. Gardeners also create a bright and attractive mulch by chipping office Christmas trees at the end of the holiday season. This mulch is stockpiled for year-round use because it reduces the amount of dry-season irrigation necessary in tree wells. LLNL also collects and recycles phone

books issued by regional telecommunications companies. These external phone books would otherwise contribute to the solid waste stream. In 1997, the laboratory recycled external phone books through a local vendor who emptied the bins when requested. In 1998, this program was incorporated into the LLNL newspaper/magazine drop-off recycling program.

The most visible component of the LLNL recycling effort is the office-paper collection and reclamation project. The laboratory operates a full-site program, with more than 120 facility collection points. Unclassified paper is transported to a contract firm where it is shredded and recycled into toilet paper and egg cartons. Classified paper is pre-processed at the Livermore site using a hammer mill destruction process.

For LLNL's UC contract, the goal is to reduce the routine nonhazardous (compactible and industrial) waste by 33% by December 31, 1999. As shown in **Table 3-4**, LLNL generated 2201 tons of routine nonhazardous waste in 1998.

Cities and counties have been required by California law to reduce nonhazardous solid waste by 25% and 50% between 1990 and 1995 and 2000, respectively. Thus, LLNL tracks and reports waste diversions to the County of Alameda. Significant reductions in 1998 have already been achieved. Compared to 1990, LLNL reduced its nonhazardous waste by almost 26%, which compares favorably with unincorporated Alameda County (8.9%) and the City of Livermore (13.8%), for 1995. Additional details are discussed in *Assessing the Nonhazardous Solid Waste Stream at Lawrence Livermore National Laboratory* (Wilson 1999).

Source Reduction and Pollution Prevention

In 1998, LLNL continued to survey on-site operations for opportunities to eliminate, reduce, recover, or recycle potential pollutants to all media, including air, water, soil, sediments, and biota.

Toxic Reporting Inventory Information

At LLNL only one chemical, Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane, also known as CFC 113), was tracked and reported as part of the Toxic Release Inventory for 1998. This reporting is required by the Emergency Planning and Community Right-to-Know Act. All other chemicals are present in quantities below the threshold reporting levels or are in a form that does not require reporting.

Freon 113, which is used in parts cleaning operations and as a coolant or refrigerant, is an ozone depleting substance whose consumption and production is slated for elimination by the year 2000. For this reason, the replacement and recycling of Freon 113 is a high priority at LLNL.

Implementing Cost-Saving Pollution Prevention (P2) Projects

As previously reported (Celeste et al. 1998) Pollution Prevention Opportunity Assessments (PPOAs) are conducted before the implementation of Pollution Prevention (P2) projects. The purpose of PPOAs is to characterize waste streams and identify those P2 options that can be implemented cost effectively.

The DOE funds P2 projects through the High-Return-on-Investment P2 Program. To date, DOE has funded High-Return-on-Investment projects at LLNL worth over $2.6 million, which has resulted in a projected annual savings in excess of $5.4 million. LLNL additionally uses return on investment calculations and estimates of project cost-effectiveness to prioritize P2 projects for resource allocation and implementation at the Laboratory.

Review of New Processes or Experiments

Many organizations at LLNL use a “front-end” review process that applies to new programs, projects, or experiments that could have a significant impact on the environment. In this review process, the initial hazardous materials projected to be used are identified, and concentrations of both the starting materials and the wastes produced are estimated. The possibility for chemical substitution, process changes, and recycling is then addressed. If an opportunity for P2 is identified, the Pollution Prevention Group will assist the generator in evaluating the options. Researchers and project managers are encouraged to implement alternatives that are less hazardous or nonhazardous.

In general, P2 activities are covered by the pertinent directorate’s P2 Plan. New activities are reviewed to identify possible P2 techniques. All personnel are encouraged to implement reasonable P2 opportunities that have been identified.

Design for Environment

In general, any means of accomplishing the goal of minimizing environmental life-cycle impacts can be thought of as an element of design for environment, a concept that involves developing an understanding of and consideration for minimizing environmental impact over the lifetime of a project, and mitigating potential environmental impacts by overlaying this understanding directly onto the design of the project. Federal facilities are now required, under Executive Order 12856, to apply life-cycle analysis and total cost accounting principles to the greatest extent practicable when estimating P2 opportunities. Both of these can be considered elements of a new federally funded facility. In addition, Executive Order 13101, which replaced Executive Order 12873 in September 1998, requires federal facilities to implement P2 by giving preference to the purchase of environmentally preferable products and requires that pollution prevention and life-cycle analysis be considered when plans, drawings, work statements, and specifications are developed. Executive Order 13101 also allows the use of "multi-media" EPA inspections of federal facilities, including compliance with this order.

The first NIF Pollution Prevention and Waste Minimization Plan was completed in 1998 (Cantwell and Celeste 1998). In 1997, the Pollution Prevention Group and NIF project management completed a design-for-environment evaluation of the opportunities within the NIF Project (Harrach et al. 1998). Based on this evaluation, the laboratory is implementing recycling programs during NIF construction, developed a Pollution Prevention Plan for NIF, and implemented aqueous cleaning concepts in the design for parts and optics cleaning. The NIF Pollution Prevention Plan included PPOAs on the predicted waste streams identified in the Preliminary Environmental Impact Statement (PEIS). The PPOAs are aimed at developing waste minimization options prior to the operational phases of NIF.

Additionally, P2 measures that are technically and economically practicable are being considered in the design of the Site 300 Contained Firing Facility (CFF). Lists from architectural information exchanges and from P2 design documents are provided to the CFF design team for evaluation. The CFF project has an individual designated as the P2 coordinator for the project.

Implementing P2 Employee Training and Awareness Programs

Pollution prevention awareness information, which covers all disciplines, is disseminated in documents such as the Pollution Prevention Plan (Celeste 1997) and *A*

Comprehensive Opportunity Assessment for Pollution Prevention at Lawrence Livermore National Laboratory (Celeste et al. 1998); posters and videos at events such as Earth Day; training and orientation; conferences and workshops; membership on LLNL committees; and formal presentations to groups such as ES&H Working Group's Environmental Subcommittee.

Pollution prevention awareness is promoted through *Newsline* (LLNL's weekly newspaper) articles and administrative memos. The Pollution Prevention Group has developed a website to electronically distribute P2 information and also prepares brochures that briefly describe the P2 program at LLNL.

The Pollution Prevention Group reviews Hazardous Waste Management's Total Waste Management System (TWMS) database monthly. By reviewing this database, which tracks waste generation, the Pollution Prevention Group can identify waste streams with potential problems for each directorate and address issues in a timely manner.

Current Return-on-Investment Projects

Based on the results of some of the Pollution Prevention Opportunity Assessments, LLNL prepared some High Return-On-Investment P2 project proposals in 1998. Major High Return-On-Investment projects that were completed, were ongoing projects, or began in 1998 are listed in **Table 3-6**.

Table 3-6. High Return-on-Investment projects in 1998.

Operation	Project
Solvent-based parts washers	Replaced with water-based small parts washers
Machine shop coolant, Building 321	Installed with cold evaporators for coolant recycling
Freon 113 parts cleaning	Replaced with ultrasonic cleaning unit
Radiograph, Building 329	Installed digital conversion radiography equipment

ChemTrack

ChemTrack, which is a computerized chemical inventory system, serves as an important tool for ensuring that LLNL complies with the Superfund Amendment and Reauthorization Act (SARA) Title III and California Business Plan reporting requirements and for improving the overall management of hazardous materials. ChemTrack enhances LLNL's ability to obtain the toxic release information necessary to complete SARA 313

submittals, to improve emergency response capabilities and management of Material Safety Data Sheets (MSDSs), to more closely track specific high-hazard chemicals and other regulated substances, and to screen selected LLNL facilities for preliminary hazard analyses. ChemTrack currently has an inventory of approximately 178,000 chemical containers ranging from 210-L drums to gram-quantity vials.

Current Issues and Actions

Many current issues and actions are described in this report according to chapter subjects. This section lists several not covered elsewhere.

ATSDR Assessment

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency whose mission is to prevent exposure and adverse human health effects and diminished quality of life associated with exposure to hazardous substances from waste sites, unplanned releases, and other sources of pollution in the environment. As part of its mission, ATSDR is mandated by Congress to conduct Public Health Assessments (PHAs) at sites, such as LLNL, that appear on the National Priorities List.

In 1997, ATSDR conducted site team meetings to identify site-related health concerns to be evaluated as part of the PHA review process. ATSDR worked with the California Department of Health Services (CDHS) to complete two health consultations related to Livermore site operations, which will likely be part of the final PHA for LLNL. The first draft health consultation report assessed concerns related to the discovery of plutonium at levels above background in Big Trees Park, Livermore. The second draft report assessed the potential impacts on water quality of the municipal water supply that serves the city of Livermore and identified private wells located in the vicinity of LLNL.

Although neither draft report identified any health risks, each report made several recommendations for further action. To resolve public concern raised during the process, LLNL voluntarily initiated another sampling program for Big Trees Park. The first sampling program was conducted in 1995 and led the EPA to determine that any plutonium in the park was below the level of health concern; no further action was suggested by regulatory agencies. The 1998 sampling plan and activity was directed by the EPA, CDHS, and the Regional Water Quality Control Board (RWQCB). LLNL completed the sampling by late summer and sent the results to two independent

laboratories for analysis. (See Chapter 9 for more information the sampling and analysis.) The EPA, CDHS, and RWQCB released a statement to the media any plutonium the park was below the level of health concern. ATSDR will issue a "pathways" analysis in late 1999. LLNL continues to work with ATSDR to resolve comments on the reports.

Miniature Optical Lair Explorer

In 1994, the Operations and Regulatory Affairs Division (ORAD) developed and began using the Miniature Optical Lair Explorer (MOLE) to perform biological assessment studies at Site 300. The MOLE is a miniature tracked vehicle with a tiny camera that allows scientists to investigate subterranean tunnel systems of special-status wildlife species to determine animal presence and numbers. LLNL performs surveys for the San Joaquin kit fox, burrowing owl, and American badger before starting ground-disturbing activities to ensure they are protected, if they are present.

The MOLE was used successfully at LLNL in 1998 to survey for the presence of several special-status species with subterranean habits: the burrowing owl, American badger, California tiger salamander, and California red-legged frog. Further development and use of the MOLE will continue in 1999.

Leaking Underground Fuel Tank Studies

In 1995, LLNL led a team of researchers from the Laboratory and four University of California campuses in a collaborative study of underground contamination from leaking underground fuel tanks (LUFTs). The study, performed for the California State Water Resources Control Board (SWRCB), found that once fuel leak sources have been removed, fuel contamination generally does not spread far from the leak site. Given time, naturally occurring microbes in the soil and ground water will usually break down most of the pollutants before they can reach a source of drinking water. On the basis of this study, the SWRCB is revising its overall ground water cleanup policy, ranking cleanup sites by their risk to drinking water sources, and selecting appropriate cleanup techniques based on risk.

One of the important recommendations of the study was to identify a series of LUFT demonstration sites and to form a panel of experts made up of scientific professionals from universities, private industry, and federal and state regulatory agencies. This

panel would provide professional interpretations and recommendations regarding LUFT evaluations and closures at demonstration sites.

As a result of this recommendation the California Military Environmental Coordination Committee Water Process Action Team, Department of Defense (DoD) sites were selected in 1996. Site selection was coordinated through. Sites were selected to represent each branch of the military services with bases in California, as well as a number of Regional Water Quality Control Boards (RWQCBs) and the diverse hydrogeologic settings in California where fuel hydrocarbon contaminant cleanup problems occur. The sites selected and their corresponding RWQCB regions are: Army Presidio at San Francisco, San Francisco RWQCB; Barstow Marine Corps Logistic Center, Lahontan RWQCB; Camp Pendleton Marine Corps Base, San Diego RWQCB; Castle Air Force Base, Central Valley RWQCB; China Lake Naval Weapons Center, Lahontan RWQCB; El Toro Marine Corps Air Station, San Diego RWQCB, George Air Force Base, Lahontan RWQCB; Port Hueneme Naval Construction Battalion Center, Los Angeles RWQCB; Travis Air Force Base, San Francisco RWQCB; and Vandenberg Air Force Base, Central Coast RWQCB.

The Expert Oversight Panel, formed as part of the demonstration project, recommended an appropriate risk-management strategy at each site and the set of actions needed to achieve site closure. The strategy was based on developing conceptual models that identify potential hazards associated with sources, pathways, and receptors. The recommendations also included site-specific findings regarding natural attenuation potential and discussion with regulators.

All sites in the demonstration project were reviewed and site specific recommendations submitted to each site. A Final Program Report was released in October 1998.

As part of continuing leaking underground fuel tank studies, LLNL completed an 18-month study evaluating impacts of the fuel oxygenate methyl tertiary-butyl ether (MTBE) and submitted it to the California SWRCB. The study concluded that:

- MTBE is a frequent and widespread contaminant in shallow ground water throughout California. Of the 32,409 leaking underground fuel tank sites recognized in the state, hydrocarbons are known to have impacted ground water at 13,278. A minimum estimate of the number of MTBE-impacted sites in California is greater than 10,000.
- MTBE plumes in ground water behave differently from other semiwater-soluble fuel components such as benzene, toluene, ethylbenzene, and xylenes (BTEX).

- Evidence to date indicates that MTBE is not significantly biodegraded in ground water. Assuming MTBE resistance to biodegradation, concentrations of dissolved MTBE in ground water will eventually diminish sufficiently to meet regulatory concentration goals because of dispersion, although the time it may take to diminish may be significantly longer than for the more biodegradable BTEX compounds.
- MTBE has the potential to impact regional ground water resources and may present a cumulative contamination hazard because of the chemical's apparent resistance to biodegradation and its mobility. With a compound that appears both ubiquitous and stable, water resource management on the regional scale will become increasingly important.
- Leak prevention is a critical requirement for the continued use of MTBE to ensure future protection of drinking water resources.

Initiative to Improve VOC Cleanup Process by Using Historical Case Analysis

The goal of this initiative is to evaluate a large number of nationwide historical cases to identify common volatile organic compound (VOC) release conditions that pose low risks and can be managed with minimal effort and cost, versus release conditions that pose higher risks and warrant larger expenditures. The key to this initiative is a cross-cutting evaluation of the large amount of VOC case data that is available.

As part of this initiative, two groups have been formed: a Working Task Force (WTF) and a Peer Review Panel (PeerRP). The WTF will focus on technical issues of historical VOC case data collection and analysis and prepare draft findings and conclusions based on the data analysis. The PeerRP will review key deliverables, raise technical issues, and review and comment on draft findings, conclusions, and any recommendations. WTF includes members from the DOE, DoD, U.S. Navy and Air Force, EPA, California RWQCBs, and the Environmental Council of States' Interstate Technology and Regulatory Cooperation (ITRC) working group.

A Phase 1 final report titled, "Historical Case Analysis of Chlorinated Volatile Organic Compound Plumes" has been prepared, reviewed and submitted to the ITRC working group.

Spill Reporting

The federal government and the State of California have several distinct statutory and regulatory provisions that require responsible persons to report releases or threatened releases of hazardous materials or pollutants into the environment. DOE has also established various orders that require reporting of incidents to DOE Headquarters. These provisions have varying requirements regarding the types of releases that must be reported, the timing of the report or notification (immediate and follow-up), the content of the report (e.g., source of the release, nature of the material, and the quantity released), and the particular agencies that must be notified. Many releases must be reported under more than one provision, and compliance with one provision will not necessarily satisfy another applicable provision.

Response to Spills and Other Environmental Emergencies

All spills and leaks (releases) that are potentially hazardous to the environment are investigated and evaluated. The release response process includes identifying the release, shutting off the source (if safe to do so), eliminating ignition sources, contacting appropriate emergency personnel, cordoning off the area containing the released material, absorbing and neutralizing the released material, assisting in cleanup, determining if a release must be reported to regulatory agencies, and verifying that cleanup (including decontaminating and replenishing spill equipment) is complete. Environmental analysts provide guidance to the programs on preventing spill recurrence.

To maximize efficient and effective emergency environmental response, EPD established a 7-days-a week, 24-hours-a-day, on-call rotational position entitled the Environmental Duty Officer (EDO). Specialized EDO training includes simulated accidents to provide the staff with the experience of working together to resolve environmental issues within the regulatory structure. The on-duty EDO can be reached by pager or cellular phone at any time.

During normal work hours, Laboratory employees report all environmental incidents to the Environmental Operations Group (EOG) environmental analyst assigned to support their program area. The EOG environmental analyst then notifies the on-duty EDO of the incident, and together, they determine applicable reporting requirements to local, state, and federal regulatory agencies and to the DOE. The EDO and the EOG environmental analyst also notify and consult with program management and have 7-days-a-week, 24-hours-a-day access to the office of Laboratory Counsel for questions concerning regulatory reporting requirements.

During off-hours, Laboratory employees report all environmental incidents to the Fire Dispatcher, who, in turn, notifies the EDO and possibly the Fire Department. The EDO then calls out additional EPD support to the incident scene as necessary, and follows the same procedures as outlined above for normal work hours.

Environmental Training

Major efforts are ongoing to provide LLNL employees with training on environmental topics aimed at improved compliance. Training tasks address both specialized training for environmental professionals and training in a variety of environmental topics for employees at all levels throughout LLNL. Courses presented by EPD's Training Section are listed in **Table 3-7**.

Table 3-7. EPD training courses.

Hazardous Waste Generation and Certification	RCRA[a] Facility Management
Hazardous Waste Generation and Certification Review	RCRA for EWSF/EWTF[b]
Emergency Response for Environmental Duty Officers	New Hire Orientation
Waste Retention Tank Management	Petroleum Product Storage Tank Management
Waste Accumulation Area Operations	Hazardous Waste Sampling
Hazardous Waste Transportation	Identification of Hazardous Material
Storm Water Pollution Prevention	Low-Level Waste Generation and Certification
National Environmental Policy Act (NEPA) Compliance	SARA/OSHA[c] Refresher Training
Spill Prevention, Control and Countermeasure Training	SARA/OSHA Field Experience
TRU Waste Generation and Certification	Packaging and Shipping Operations
Legacy Waste Process Knowledge Evaluation	Environmental Duty Officer Briefings
Waste Process and Matrix Identification	Waste Management Unit OJT[d]
Waste Characterization Approval	Air Source Management
Field Fingerprint Identification	Drills and Exercises for HWM

a RCRA = Resource Conservation and Recovery Act.

b EWSF/EWTF = Explosive Waste Storage Facility/Explosive Waste Treatment Facility.

c SARA/OSHA = Superfund Amendment and Reauthorization Act/Occupational Safety and Health Administration.

d OJT = On-the-job training.

While EPD plays a central role, every directorate at LLNL is responsible for environmental compliance and minimizing the impacts of its operations. Several directorates have taken particularly noteworthy steps in this direction. These include the plans for Defense Nuclear Technologies Program's Contained Firing Facility at Site 300 that will move explosive tests inside a facility where the debris is contained, the Laser Program's efforts to design the National Ignition Facility to have minimal environmental impact, Engineering's Metal Finishing Group's efforts to reduce waste and substitute less hazardous chemicals in many of their processes, and the Education Program's efforts to enhance environmental education.

Integral to LLNL's environmental research is the Environmental Programs Directorate that conducts multidisciplinary research to assess and mitigate environmental and human risk from natural and man-made hazards and to develop and demonstrate new tools and technologies for environmental restoration. This work includes studies in the design, analysis, and testing of advanced waste-treatment technologies; in situ environmental remediation using natural and engineered processes; pathway, dosimetry, and risk analysis of radioactive and toxic substances; atmospheric dynamics; subsurface imaging and characterization; and seismic processes.

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